CURRENT SCIENCE

Vol. VI] January 1938 [No. 7.

The Indian Science Congress Silver Jubilee.

THE Silver Jubilee of the Indian Science Congress, which was celebrated in Calcutta this month, is an event over which everyone must rejoice who has at heart the welfare of science in India. We offer our congratulations to the Congress and extend a warm welcome to the foreign delegates who are attending.

It would be difficult to overestimate the importance of the Indian Science Congress to scientific progress in India. In the opening years of the century, though Indian scientific research already had a long and honourable history, it was confined almost exclusively to the members of the various scientific services of Government, and was almost non-existent in the universities and their constituent colleges. Already, however, the need for the vitalising of university teaching by association with active research work was being realised and in November, 1912, the Indian Science Congress was founded to afford definite annual occasions for the meeting together of research workers and others interested in scientific studies. It was welcomed alike by the scientific services as affording a meeting ground for members of different services with common interests, and by the universities, colleges, etc., as affording similar opportunities for the members of their staffs.

Many members of these staffs were keen enough to take up research work, but found great difficulty in finding time for it among their heavy teaching and administrative responsibilities. And as in most places no real provision for research was made, as regards either library facilities or equipment, it is not to be wondered at that their keenness was apt soon to dwindle and disappear when the stimulus of contact with active research workers was also lacking. The Indian Science Congress provided for such contact, with the result that keenness has been kept alive, time has gradually been found and more and more facilities have been provided, till as we look round at the steady work now being done in colleges all over the country, it is hard to realise that this was scarcely existent only twenty-five years ago. Other forces besides the Science Congress have, of course, been at work to bring about

this result, but this does not alter the fact that its annual meetings have been of vital importance.

The meetings of the Science Congress reflect the general intellectual development that has taken place throughout the country as a result of the spread of research work and the vitality it imparts to learning. At the earlier meetings very few contributors knew how to present their papers, which they laboriously read at full length to an audience where few if any would be able fully to understand even if they could at one reading grasp their meaning. Some there are who still thus inflict themselves upon their audience, but a steadily increasing number not only realise its futility but have become skilled in the art of selecting salient facts and presenting them in such a way as to interest all present, leaving the details for reference by specialists after the paper has been published. Not long ago the Madras Premier was pleading with the Madras Library Association for the putting aside of writings and a return to the ancient Indian tradition of using the living spoken word only. When the Indian Science Congress was founded there were very few scientific societies in the country that held meetings where this art could be practised, and the vast majority of Indian scientists had no opportunity of regularly attending any of them and of learning how to spread a knowledge of the truths their work was helping to reveal.

The Indian Science Congress has thus played a most important part in the recent rapid development of scientific work and influence in India, not only as a direct incentive to research but also by the way in which it has linked personally together sparsely scattered scientific workers from all over the country, making possible for the first time the growth of a wide-spread healthy atmosphere of scientific culture and co-operation.

The Asiatic Society (now the Royal Asiatic Society) of Bengal, as is well known, played by request a most important part in the fostering of the Science Congress during its earlier years, and the informal relationship thus established still happily persists. So helpful was the assistance given in early years that in his Presidential Address to the 1928 meeting, in which the history of the beginnings of the Congress are recorded, Prof. Simonsen says, "So far as I can see the Society has not had any direct benefit from the connection, whilst to us it has been of incalculable value. On financial grounds alone I do not think that without their aid we could have survived." By now the Indian Science Congress has been able similarly to assist other more recently conceived causes. *Current Science* itself, we are glad to acknowledge, came into being as the result of an informal meeting of scientists from all over India called together at the instance of members of the Indian Institute of Science and other bodies, during the Bangalore Meeting of the Congress in 1932; and the harmony established between the various all-India scientific societies that have been formed, for the most part comparatively recently, in different centres, is due in no small measure to the negotiations of a special Committee appointed by the Science Congress at its 1934 meeting.

The general plan on which the Indian Science Congress was conceived and built up was that of the British Association for the Advancement of Science, and it is therefore peculiarly fitting that its Silver Jubilee should be celebrated by a joint meeting with that body. But it must not be supposed that the former is simply a copy of the latter. Distances in India are so much greater than in Britain, that travelling takes much longer and costs much more. Consequently it is not possible for any large number of people habitually to attend every meeting. But those who endeavour to do so form a nucleus for gatherings, the composition of which varies in accordance with the geographical locations of the particular meeting but is always far from being confined to residents of that particular city or even Province or State. The Indian Science Congress may thus perhaps be said to bear a relation to its individual members intermediate between that borne by the British Association to its members in the British Isles and in the Dominions. Nor is this the only adaptation that has taken place to meet the need of Indian conditions.

The Indian Science Congress has already given twenty-five years of notable service to the country. We join in the thanks that must be given to those who have devoted their time and thought to its welfare, and we look forward to a period of steadily increasing utility for it in the future.

The Silver Jubilee of the Indian Science Congress.

By Gilbert J. Fowler, D.Sc., F.I.C.

IN the year 1914, the year notable in history as the beginning of strife, two British Chemists conceived the idea of uniting the various conflicting elements in the sub-continent of India, in a common devotion to the study of natural science. It is now 25 years since the Indian Science Congress was founded as the result of the inspiration of these two pioneers. Its membership has grown from a minimum of 270 in 1915 to a maximum of 800 on various occasions. The Silver Jubilee Meeting which is the subject of this article, attained a membership of approximately 2,300. During the period of 25 years whose close is celebrated by the Silver Jubilee Meeting the number of Sections has increased from 6 to 10. The Section of Agriculture was added in 1915, the Sections of Zoology and Ethnography combined, in 1917, and the Section of Medical and Veterinary Research in 1919. In 1921 the Section of Anthropology and Ethnography began, in 1925 the Section of Psychology, and in 1936 the Section of Physiology. The somewhat loose organisation of the early years has been converted into an ordered Association, with a defined constitution and membership, known as the Indian Science Congress Association. It may be fairly concluded also that other bodies devoted to various aspects of scientific inquiry as, *e.g.*, the recent Indian Statistical Conference in Calcutta owe their inception in part to inspiration derived from the Indian Science Congress Association.

Its influence on the output of research in India has been considerable judging by the number of papers contributed at the annual meetings. The total number of papers read in 1914 was only 35 from a membership of 300 or rather more than one paper for every 10 members. In 1935, 820 papers were contributed by a membership of 800 or rather more than one paper per head. 1935 represents the high water-mark in membership and in the number of papers up to the present year, though other years have seen a greater per head production. How far this output of papers represents true scientific progress is matter for discussion but at any rate it shows a very considerable increase in zeal and enthusiasm on the part of the younger generation of scientific workers.

The memorable meeting which has just closed gives perhaps a truer measure of the real advance which has taken place during the 25 years which have elapsed since the seed was sown by the pioneers. Among the intensive activities of the Silver Jubilee Week it is not easy to select those which were of fundamental importance, when nearly all were of interest. To obtain some idea of the work of the Silver Jubilee Week it may be convenient to classify these activities under various categories, namely, (i) Presidential speeches and addresses, (ii) Discourses by specialists on their own sphere of work, (iii) Joint discussions under a planned programme of subjects of special interest, (iv) Papers mainly contributed towards a specific objective, (v) Papers of miscellaneous interest, and (vi) Popular lectures by outstanding scientists. Apart from the various Addresses and Sectional Meetings and Discussions there were the Annual Meetings of at least ten scientific bodies. Added to these were lunches, dinners, garden parties and excursions.

It will be seen therefore that it is not easy to record in a necessarily brief article the outstanding impressions of such a varied gathering.

The opening addresses of the Vice-Chancellor of the Calcutta University in requesting His Excellency the Viceroy to open the Congress, His Excellency's own speech and, most memorable of all, the address prepared before his lamented passing, by the President elect, Lord Rutherford, all stressed the same ideal, the progress of India towards a higher standard of life and her contribution to world peace, through her emphasis on the spiritual aspect of scientific progress.

His Excellency pointed out that the aims with which the Indian Science Congress was founded were three-fold: firstly, to encourage research and to publish the results among scientific workers in India, secondly, to give opportunities of personal intercourse

and scientific companionship and thirdly, to promote public interest in science. These aims, he said, had been magnificently fulfilled.

In the exceptional interest taken by everyone, both scientists and laymen, in the wonderful advances associated with the name of Rutherford, it is sometimes forgotten that of late years, in addition to his main pre-occupation with research in pure science he has also, as Chairman of the Advisory Council of the Department of Scientific and Industrial Research, been closely connected with modern industrial developments in Great Britain. One half of his address was concerned with the subject of industrial research and there is no doubt that his references to the needs of India in this respect will be carefully considered.

Sir James Jeans in his Inaugural Address as President of the Congress, paid a magnificent tribute to the genius of Rutherford, speaking of him as the Newton of Atomic Physics. In the absence from his career of any bitter controversy, Rutherford was indeed more fortunate than Newton. "He was ever the happy warrior, happy in his work and happy in its outcome and happy in its human contacts." After a generous appreciation of the work of outstanding Indian Scientists Sir James devoted most of his address to reading extracts from the address prepared by Lord Rutherford prior to his passing.

Following the opening addresses, His Excellency conferred the Honorary Silver Jubilee Membership of the Indian Science Congress Association on a number of distinguished scientists, both Indian and European.

The addresses of the Sectional Presidents were necessarily of specialist interest and are not easily summarised by an outsider. Even Dr. Normand's address to the Section of Mathematics and Physics on the 'Sources of Energy of Storms,' is rather hard reading for the non-mathematically minded. Dr. Bhatnagar's address to the Section of Chemistry on a 'Survey of Recent Advances in Magnetism relating to Chemistry' is based on 204 references and the mass of information collected is somewhat overwhelming. The impossibility of attending each day during the Week more than a certain chosen few of the great number of addresses and meetings available for attendance makes it also impossible to refer to all the numberless items of interest, which must have been brought forward during the meetings. Therefore those referred to in this article must necessarily be mainly such as came within the purview of the writer.

The second category, namely, discourses by specialists on their own sphere of work were undoubtedly in every case a privilege to listen to. The only one of these which the present writer was able to attend was by Professor E. C. C. Baly on his recent work in Photo-synthesis, and was a fine example of the closely critical methods which have to be followed if research in this field is to be established on sure foundations.

The discourse of Professor F. E. Fritsch on 'The Nature of the Subterranean Algal Soil Flora' prefaced an exceedingly interesting and prolonged discussion introduced by Professor M. O. P. Iyengar of Madras on algal problems peculiar to the tropics, with special reference to India. The discussion lasted the whole of one morning and malaria experts, chemists and engineers all spoke to the subject. Unfortunately no really satisfactory solution to the numerous problems ranging from malarial control to corrosion of condenser tubes seemed to be in sight.

Another discussion of great interest was held under the Chairmanship of Sir Henry Tizard, the subject being 'Chemistry and Industrial Development in India'. The speakers were rigidly confined by the Chairman to speeches of 5 minutes duration bearing on specific points which he had chalked out on the blackboard. In consequence the discussion was lively and useful, emphasis being laid on the training of students with a view to developing 'machine sense' or 'technical sense' as it was variously described, and on the need for collection of satisfactory data concerning production in relation to possible markets.

A discussion on the attractive and important subject of River Physics did not actually take place since the preliminary

papers, although of great interest and value, were too long and too specialist to permit of any immediate consideration.

The experience gained through the abovementioned, and other more or less successful discussions, *e.g.*, 'On Colloids in Biology, Medicine and Agriculture' and 'The Absorption of Salts by Plants' will doubtless be useful in arranging future programmes. There can be no doubt that these discussions are of the greatest interest and value but for their success they need careful "planning". The introductory papers should be short and available to speakers in advance. The speakers should be chosen for their knowledge of the subject and also, if possible, for their capacity of "putting it across" to the audience, in such a way as to stimulate further discussion and research and not merely to add more facts to those already submitted.

A similar observation might be made with regard to the more or less routine papers submitted to Sections. In the Chemistry Section there was a total of 221 papers of which 137 came under the head of Organic and Biochemistry. Clearly justice could not possibly be done to such a list and a definite resolution was passed in the Committee to select in future for actual reading only such papers as were clearly of importance and of general interest.

The need for greater contact between activities of scientific bodies and the lay public has been emphasised of late years in the programme of the British Association. The Indian Science Congress Association is evidently following this example. The numerous important "Discussions" are a move in this direction and at every one of the public lectures the Senate House of the Calcutta University was filled 'to capacity'. Naturally such names as Eddington and Jeans were an unfailing attraction. Large audiences however listened to Professor Aston on 'Isotopes' and Professor Fleure on 'The Idea of the Nation in Europe'.

The last public lecture was given on the Sunday morning, the closing day of the Congress by Viscount Samuel and formed a fitting conclusion to the deliberations of the week. Lord Samuel who is President of the British Institute of Philosophy took as his subject 'Science, a Basis for Philosophy'. He spoke of the age-old interest of India in things of the mind and her modern contact with physical science depending upon the observation of facts, upon experiment and measurement. It might be thought that the tendencies, ideas and practices of India would be antagonistic to this modern movement. Professor Radhakrishnan however had declared that Hindu thought has no mistrust of reason. On the other hand, there is a new movement in Philosophy specially in Great Britain and America which tends to link it with science and looks to the established conclusions of science as the premises for Philosophy. So it might be hoped that 'Philosophy coming out of its phase of classicism, science coming out of its phase of materialism and religion from its servitude to dogmas that are outworn, may join in constructing a spiritual and intellectual framework for the future.'

There can be no doubt that with these and many other thoughts of a like nature which have been voiced on one occasion or another during the vivid week of the Congress, those who foregathered in friendly intercourse either on the river trip or at the numerous lunches, garden parties and at the Congress Dinner, where a great assembly sat down together and listened to speeches of high idealism, will have come away feeling that the world is not yet at the mercy of blind and aggressive forces of destruction, that "there is no darkness but ignorance" and that in the light of truth, sought for its own sake, all that is best in Eastern and Western cultures may come together to build a better world.

Sound Velocity and Chemical Constitution.

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INVESTIGATION on the measurement of sound velocity in liquids was, until 1923, a difficult problem for experimentation, on account of the large quantities of the liquid required and of many uncertain corrections involved therein. The measurements were made by the Kundt's tube method in the audio range, and naturally even for one wave-length, a large column of liquid was required. Sea-water and a few organic liquids formed the whole list of liquids investigated.

The subject took an entirely different turn when Langevin applied the piezo-electric property of quartz and electrical oscillating circuits to the production of high-frequency sound waves. One could then use smaller quantities of liquid and determine the nodes by a probing pin, noting the reaction in the circuit. Of the methods based on the use of the piezo-electric oscillator for the measurement of ultrasonic velocity in liquids we may mention four :—

(1) The acoustic interferometer invented by Pierce[1] and used amongst others by Freyer, Hubbard and Andrews[2] in the United States of America ; and by Boyle[3] and co-workers in Canada.

(2) The method of the diffraction of light by sound waves originated by Debye and Sears[4] in America and by Lucas and Biquard[5] in France ;

(3) The visibility method developed extensively by Hiedemann[6] and co-workers at Köln ;

(4) The periodicity phenomenon[7] first demonstrated almost simultaneously, and independently, by the author[8] and by O. Nomoto.[9]

Amongst these the method of Debye-Sears and of Lucas-Biquard is very simple, precise and rapid. When the author took up the investigation on the relation between sound velocity and chemical constitution data[10] for acoustic velocity in the audible range were availabale for hardly 20 organic liquids and no definite correlation could then have been made. He has now investigated over 125 organic liquids and has drawn some important conclusions therefrom. In this brief article an attempt is made to bring out all the salient points, but for greater details the original papers must be consulted.

1. Aromatic compounds have usually higher velocities than the aliphatics. For the former the range is 1300 m./s. and above at 25° C., while for the latter compounds 1300 m./s. is about the upper limit. Cyclohexane and its derivatives come midway.

2. As the length of the molecule increases, the velocity of sound also increases. This is amply borne out in the case of hydrocarbons,[11] alcohols and ketones, and also in compounds containing two bromine atoms, which are progressively separated, as shown in Table I.

TABLE I.

Liquids	Density	Velocity in m./s.
Alcohols—		
Methyl alcohol	0·792	1130
Ethyl	0·786	1207
Propyl	0·801	1234
Butyl	0·808	1315
Amyl	0·814	1347
Bromine compounds—		
CH_2Br_2	2·453	971
CH_2Br-CH_2Br	2·178	1014
$CH_2Br-CH_2-CH_2Br$	1·977	1144

In the case of alcohols the velocity increases in spite of the density increasing, while in the bromine substituted compounds, the increase is regular for a regular diminution in density, which is as it ought to be.

However, esters form a class by themselves.

3. As remarked above, the esters show a diminution in velocity with increasing length of the alcohol radical. This is exemplified in Table II, where the velocities are given for various acetates.

TABLE II.

Liquids	Density	Velocity in m./s.
Methyl acetate	0·928	1211
Ethyl	0·899	1187
Propyl	0·884	1182
Butyl	0·872	1179
Amyl (iso)	0·874	1168

4. Introduction of a heavier atom into the molecule brings down the velocity. Methylene and ethylene halogen substituted compounds form such series where the difference can be easily noticed. It is also remarkable to note that the introduction of a greater number of the same heavy atom also tends to lower the acoustic velocity.

(a)	$CH_2:Cl_2$	1064	m./s.
	$CH_2:Br_2$	971	,,
(b)	$CHCl_3$	1001	,,
	$CHBr_3$	930	,,
(c)	$CH_2:Cl_2$	1064	,,
	$CHCl_3$	1001	,,
	CCl_4	928	,,
(d)	$CHCl_2{\cdot}CHCl_2$	1155	,,
	$CHBr_2{\cdot}CHBr_2$	1007	,,

The velocities are comparable among themselves in each group, as the temperature difference is not above 0·5° C.

In the case of methylene iodide the velocity for which is 977·7 m./s. probably greater viscosity compensates for the lowering in velocity due to the iodine atom. There seems to be general agreement throughout.

5. Highly viscous liquids have greater velocities. For example, ethylene glycoll is more viscous than ethyl alcohol and has a higher velocity. Similarly, aniline, anisol, and acetophenone are examples of liquids having higher velocity than their parent compounds.

6. Among isomers, if isomerism is not of the optical kind, there is a difference in acoustic velocity. For example, the xylenes α- and β-picolines, butyl and *iso*-butyl alcohols show such differences. But the optical isomers, the *d*- and *l*-pinenes possess identical velocity.

7. Speaking of substitution, we may mention here that a methyl radical introduced into an ester or an ether, in place of an ethyl group raises the sound velocity. As examples, we give :

(a)	Ethyl chloracetate ..	1234	m./s.
	Methyl ,, ..	1331	,,
(b)	*o*-Cresol ethyl ether ..	1315	,,
	o-Cresol methyl ether..	1385	,,

Many other examples are given in the original papers.

8. It has been observed that usually the introduction of a double bond favours lowering of the acoustic velocity.

$CHCl = CHCl$ .. 1025 m./s. at 25°·5 C.

$CHCl_2 - CHCl_2$ .. 1155 m./s. at 28° C.

In spite of the fact that acetylene dichloride has only 2 chlorine atoms compared with acetylene tetrachloride, and a lower density it possesses a lower sound velocity. Other examples where it is shown that unsaturation lowers the velocity are allyl chloride and tetrachlorethylene.

9. Similarities in the behaviour of ethers and esters with respect to the sound velocity have been brought out clearly in the original papers which should be consulted for details.

10. It has been shown that molecules possessing an electric moment tend to show enhanced sound velocities. As examples, we give :—

(i)	Benzene ..	1310 m./s. at 23°	C.
	Nitrobenzene ..	1455 ,, ,, 28°	C.
(ii)	Cyclohexane ..	1257 ,, ,, 23°	C.
	Cyclohexanone ..	1441 ,, ,, 23°·5	C.

The above are the general findings on the relation between sound velocity and chemical constitution of organic liquids. These have been amply borne out in the investigations carried out by the author.

[1] Pierce, *Proc. Amer. Acad. of Arts. & Sci., Boston*, 1925, 60, 271.
[2] Freyer, Hubbard and Andrews, *J.A.C.S.*, 1929, **51**, 759.
[3] Boyle and co-workers, *Trans. Roy. Soc. Canada*, **17**, *et seq.*
[4] Debye and Sears, *Proc. Nat. Acad. Sci., Washington*, 1932, **18**, 409.
[5] Lucas and Biquard, *C. R.*, 1932, **194**, 2132 ; 1932, **195**, 121 ; and *Journ. de Phys. et la Rad.*, 1932, **3**, 464.
[6] Hiedemann, Asbach and Bachem, *Zeit. f. Physik*, **87**, 442, 734 ; and subsequent volumes of *Zeit. Phys.*
[7] Winkelmann, *Ann. d. Phys.*, 1908, 27, 905.
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Nagendra Nath, *Proc. Ind. Acad. Sci.*, 1936, **4**, 262.
Hiedemann, *Zeit. f. Phys.*, 1937, **107**, 403.
[8] Parthasarathy, *Proc. Ind. Acad. Sci.*, 1935 and 1936 ; *Curr. Sci.*, Nov., 1937.
[9] Nomoto, *Proc. Phys. Math. Soc., Japan*, 1936, **18**, 402.
[10] See *International Critical Tables*, Vol. VI.
[11] Bergmann and Jænsch, *Sitz. Ber. Schles. Ges. f. Vaterl Kultur*, 1936, **108**, 34.

Monographs.

Bergmann, *Der Ultraschall*, 1937.
Grossmann, "Ultraakustik", in *Handbuch der Experimental Physik*, 1934.
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Vitamin C Subnutrition in Indians.

By K. Ramakrishnan Nair.

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THE rarity of clinical scurvy under ordinary conditions of life has tended to minimize the importance of vitamin C in the normal dietary. With the identification of this vitamin with ascorbic acid it began to be recognised that it must play a fundamental rôle in metabolism on account of its ability to take part in biological oxidations and reductions. Recent clinical and laboratory investigations have fully borne out this view. On the one hand, it has been shown that vitamin C therapy exerts marked beneficial effect in pathological conditions so varied as pneumonia (Gander and Niederberger, 1936), cataract (Josephson, 1935) and diphtheria (King and Menten, 1935) and further that there is a correlation between partial deficiency of vitamin C and the incidence of tuberculosis (Heise and Martin, 1936) and of rheumatic fever and arthritis (Rinehart and Mettier, 1934). Yarovsky, Almaden and King (1934) from the vitamin C content of tissues from hospital autopsies conclude that over 20 per cent. of the cases revealed a condition of latent scurvy. Similar conclusions in regard to patients admitted to hospitals in Cambridge and Manchester are reached by Harris and Ray (1935) while according to Orr (1936) half the English population receive less than their optimum of vitamin C.

Harris and Ray (*loc. cit.*) have demonstrated that urinary excretion of acsorbic acid and especially the increase in excretion in response to a massive dose of vitamin C provide simple criteria for determining the state of vitamin C nutrition of an individual. For persons receiving adequate amounts of the vitamin, the daily excretion in the urine is about 30 mgm. which suddenly rises to about 160 mgm. after ingestion of sufficient ascorbic acid to saturate the tissues (600 mgm. are usually given).

Using these criteria and the Birch, Harris and Ray (1933) method for estimation of vitamin C, fifteen 'normal' individuals (mostly students) were examined. The results are given in Table I. It will be seen that only in three out of the fifteen cases, studied (Nos. 8, 11 and 14) was the normal response obtained. In all the other cases not only was the initial excretion low but it showed little or no increase after the test dose of 600 mgm. In two cases (Nos. 1 and 2) where the test doses were repeated a steep

TABLE I.

Urinary Response to Doses of Vitamin C Redoxon Roche.

Subject	No. of dose	No. of mgm. excreted in urine before and after doses of 600 mgm. each	
		In 24 hours before	In 24 hours after
1	1	20·10	19·95
	2	19·95	21·37
	3	21·37	72·26
	4	72·26	134·01
2	1	19·22	20·70
	2	20·71	21·11
	3	21·11	197·00
3	1	17·93	16·72
4	1	16·57	17·41
5	1	13·95	14·70
6	1	14·71	14·55
7	1	21·00	22·50
8	1	29·72	111·50 Normal
9	1	20·02	20·05
10	1	17·77	16·80
11	1	30·20	98·00 Normal
12	1	22·90	21·00
13	1	14·95	14·40
14	1	28·94	88·82 Normal
15	1	19·84	19·00

rise in the excretion did occur, but only after four doses in the first case and after three doses in the second case showing that saturation could be obtained if sufficient vitamin is administered, thus ruling out any climatic or racial factors.

Assuming the validity of Harris's tandards, it would appear from these preliminary experiments that, on the South Indian middle class dietary, partial deficiency of vitamin C is the rule and optimal intake the exception, in agreement with the conclusions reached by Ranganathan and Sankaran (1937). The experiments are being extended to include a larger number of individuals.

Acknowledgements are made to Messrs. Hoffmann-La Roche & Co., for the free supply of vitamin C 'Redoxon Roche,' to the Lady Tata Memorial Trust for a

research grant and to Prof. M. Damodaran who suggested the investigation.

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The International Commission of Snow.

THE International Commission of Snow, authorized by the International Association of Scientific Hydrology at Lisbon in 1933, held its first gathering in Edinburgh, September 1936, as part of the International Union of Geodesy and Geophysics. The Snow Commission's program was made purposely broad to create a background of universal interest and to point out the many needs to be served. In outline the subject included Measuring Precipitation, Snow Cover and Snow Surveying, Influence of Snow on Runoff, Avalanches, Transport, Ice on Lakes and Rivers, Physical Properties of Snow and Ice, Glaciers, Icebergs, Reports of Recent Expeditions to the Arctic and Antarctic, and Apparatus. The proceedings will be published in full.

The next international meeting is to be held in Washington in 1939. Officers of the Commission representing the three major fields of investigation are J. E. Church (U.S.A.), President, *Snow*; Antoni B. Dobrowolski (Poland), Vice-President, *Ice*; Peter Stakle (Latvia), Secretary, *Cold*.

The problems formally assigned for investigation and report in 1939 are: (1) The permeability of snow with respect to water. The capacity of the snow to retain water; (2) Influence of snow and ice on the flow of streams with reference to the condition of the ground, as to whether it is normal or frozen, and to condensation; (3) Compilation of snow maps of all countries. Informal activities include the interchange of information on all problems of snow and ice. In illustration mention may be made of the following problems referred to the Commission: (1) Explanation of the cause of the abnormal and seemingly persistent low minimum flow in the Punjab, India; and (2) Review of a new method of selecting sites for snow-survey courses on the upper Columbia River in British Columbia.[1]

Mountaineering and exploration are already including snow-surveying in their program. A Mount Rose Snow Sampler was requested by the American-British Expedition to the Himalayas this past (1936) summer, and others have been requested by an American expedition planning to return to the Greenland Ice-cap. Dr. Frederick W. Lee, Chief of the Geophysical Division of the U.S. Geological Survey, has developed a light electrical resistivity meter to measure the depth of snow and ice. John C. Stevens has developed a portable springless balance for weighing evaporation pans. Snow Sports are being added as a division in close association with Avalanches. In America forecast have already begun regarding winter-sport conditions in the National Parks, and in the future radio broadcasts on them will be given in connection with those on snow surveys.

Akin to this, though carried on as pure research by the Central Geophysical Observatory at Leningrad, is a Soviet investigation of snow crystals under varying meteorological conditions. This investigation would be of practical interest in the Arctic where the Eskimos have several names for snow and are as interested in the effect of various types on the slipping of their sledges as is a skier in the various types of ski wax. The government of Argentina has now inaugurated a comprehensive snow-survey system, and the scientists of Argentina and Chile are investigating high mountain snows, such as the "nieve penitente".

In the interval between international gatherings meetings of national groups are proposed. The British group is already fully organized; its chairman is Gerald Seligman, former President of the Ski Club of Great Britain, and a number of meetings have been held.[2]—J. E. CHURCH, *Pres.* (*Bull. Amer. Met. Soc.*, 1937, **18**, 373.)

[1] A discussion of these problems by R. C. Farrow appears in the *Trans. Amer. Geophys.* and May, 1937, pp. 60–2, 92.—*Ed.*

[2] Cf., *Geogr. Rev.*, July, 1937, p. 504; The Commission has issued mimeographed reports of these to its members; see also *Met. Mag.*, April and May, 1937. pp. 60-2, 92.—*Ed.*

The Size of *Nicotiana rustica* × *Nicotiana tabacum* Hybrid Embryos and Hybrids in Respect to their Parents.

By Dontcho Kostoff.

(*Academy of Sciences of USSR, Institute of Genetics, Moscow.*)

ASHBY (1930, 1932) in studying the problem of hybrid vigour in maize, found a dependence between the size of the hybrid embryos and the hybrid vigour. According to Ashby (1936) "the final size of a plant is the resultant of the initial size of its primordia and the relative growth-rate. Since in relative growth-rate the hybrid had no advantage over its parents, size-heterosis must have been due to an initially bigger primordium. In other words, if the rate of compound interest in the hybrid is no bigger, its capital of dividing cells must be higher. The simplest way to measure this capital is to dissect the primordia (plumule and radicle) from the embryo and weigh them. When this was done it was found that the hybrid embryos were bigger than those of either parent, and the size heterosis observed in these experiments was due solely to the maintenance of this initial advantage in primordial size" (Ashby, 1936). He recorded that he has obtained the same results in experimenting with beans and six strains of tomatoes. Ashby's (1930–37) statements were recently supported by Luckwill (1937).

In studying the cell size in vigorous and dwarf hybrids, Kostoff and Arutiunova (1935, 1936) found that the vigorous hybrids have not larger cells than their parents, consequently their vigour is attained by more rapid cell division.

What concerns the relation between embryo sizes and "vigour" I found some data in *Nicotiana* species crosses which show that hybrid embryos might be very small, much smaller than the embryos in either parent, nevertheless, the hybrids that develop from them are very vigorous. This phenomenon can be observed in a series of interspecific hybrids in *Nicotiana*. I shall give here, however, as an example, the cross *Nicotiana rustica* × *N. tabacum.*

Hybrid embryos in mature seeds produced by crossing *N. rustica* with *N. tabacum* are very small. A large number of them do not germinate but even those that do germinate are much smaller than the embryos of either parents. I have crossed flowers of *N. rustica* with pollen of *tabacum* and at the same time I selfed flowers from the parental species. The capsules became yellowish, thirty days after the crossing and selfing and the seeds dark-brown, which means that they were mature. Such capsules were fixed and from them paraffin sections were made. Then the embryos were measured and the data obtained are given in Table I.

TABLE I.

The Length and the Breadth of the Embryos 30 days after Pollination (i.e., when it is Completely Mature).

No.	Embryos from species and hybrids	Somatic chromosomes	Length in microns			Breadth in microns		
			n	M	σ	n	M	σ
1	*N. rustica* selfed ..	48	150	998·5	12·1	150	764·3	9·6
2	*N. tabacum* selfed ..	48	150	684·2	10·5	150	503·7	8·4
3	The cross F_1 *N. rustica* × *N. tabacum*	48	150	181·7	18·1	150	126·3	15·3
4	Amphidiploid *N. rustica—tabacum* ..	96	20	936·3	15·6	20	718·2	11·7

I raised plants from hybrid seeds *N. rustica* × *tabacum* as well as from the pure parental species under equal environmental conditions and the plants were measured at the end of their florescence period (October 8th). It was found that from exceedingly small embryos, very vigorous F_1 hybrids have developed.

I also included in the experiment the amphidiploid *N. rustica — tabacum* plants (2n = 96). They also were much larger in size than the parental forms, but smaller than the F_1 hybrids (Table II). It should

TABLE II.

The Size of the Parental Plants and the Hybrids in cm.

No.	Species and hybrids	Somatic chromosomes	n	M	σ
1	*Nicotiana rustica* ..	48	30	82·8	2·9
2	*Nicotiana tabacum*..	48	30	96·2	3·0
3	F_1 hybrid *N. rustica* × *tabacum* ..	48	9	148·5	2·9
4	Amphidiploid *N. rustica—tabacum*	96	20	128·9	3·7

be mentioned here that amphidiploid *N. rustica — tabacum* is not constant (Kostoff, 1937) because it forms quadrivalents, trivalents and univalents during the meiosis which accounts for its greater variability ($\sigma = 3{\cdot}7$) no matter that for the experiment uniform seedlings were selected, which were morphologically like F_1 hybrids.

Hybrid embryos in our case are smaller than those of either parents, because their physiology in general and the physiology of development in particular, is different from that of the maternal plant. The hybrid embryos *N. rustica* × *tabacum* are somewhat foreign for the maternal plant *N. rustica* having 50 per cent. of its genetic nature from *N. tabacum*. If the hybrid embryos were not grown on maternal plant they probably would not be as small as they really were. The reactivity of the maternal organism might also suppress somewhat the hybrid embryos in some respects, the latter being somewhat foreign for the mother (*cf.* Kostoff, 1930).

These ideas were inferred on the basis of the relative size of the normal embryos, hybrid embryos grown in *N. rustica* organism, and the hybrid embryos that develop in the amphidiploids, the latter being considerably larger than those grown in *N. rustica* organism, no matter that they have about the same genetic constitution. It seems that the differences in size of amphidiploid embryos and F_1 embryos are not exclusively due to the polyploid nature of the former.

Ashby, E., *Ann. Bot.*, 1930, **44**, 457.

—, *ibid.*, 1932, **46**, 1007.

—, *Amer. Naturalist*, 1936, **70**, 179.

—, *Ann. Bot.* (New Series), 1937, **1**, 11.

Kostoff, D., *Genetica*, 1930, **12**, 33.

—, *Compt. Rend. (Doklady) Acad. Sci. USSR*, 1937, **14**, 453.

— and Arutiunova, N., *Archivio Botanico*, 1935, **11**, 264.

— —, *Zeit. f. Zellf. u Mikr. Anat.*, 1936, **24**, 427.

Luckwill, L. C., *Ann. Bot.* (New Series), 1937, **1**, 379.

The Hayes Radiometer as a Fog Signal.

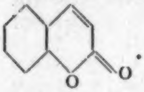
FOG, shipping's deadliest enemy, appears one step nearer defeat with the announcement of successful heavy weather signalling by means of the Hayes Radiometer, originally invented as an extremely sensitive device for measuring heat radiation. Its inventor, Hammond V. Hayes of Boston, reports in the September, 1937, *Review of Scientific Instruments*. The instrument makes practical the long hoped-for means of signalling by use of heat radiation instead of light. Heat rays penetrate foggy and thick atmosphere much more strongly than does light. Boston harbour during the last winter was the trial ground for the radiometer, which is being improved as a result of the first experiments. Signals were sent successfully a distance of more than a mile and a half on days when visibility was so poor that objects situated much nearer than the heat source could not be picked out.

—Sci. Serv., Sept. 14, 1937.

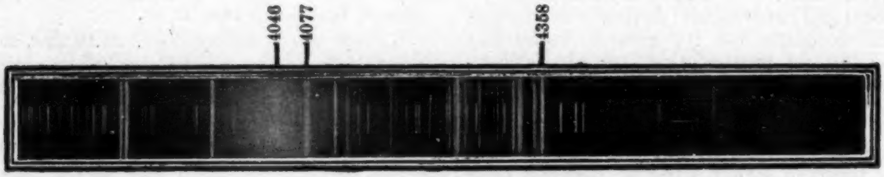
LETTERS TO THE EDITOR.

The Raman Spectrum of Coumarin.

An important class of organic compounds whose Raman spectra have not been hitherto investigated is the one containing the pyrone ring. Coumarin or benzo-α-pyrone is typical of this group and has a structure



. In the course of an investigation of the nature of the low frequency oscillations in a large number of organic substances, I have obtained an intense Raman spectrum rich in lines, for crystalline coumarin, which is reproduced below.



The Raman Spectrum of Coumarin.

The Raman frequencies recorded are the following :—34 (2), 50 (4), 65 (1), 83 (3), 101 (3), 445 (6), 485 (2), 522 (3), 726 (7), 760 (4), 889 (3), 950 (1), 993 (2), 1030 (7), 1045 (0), 1098 (6), 1120 (7), 1152 (6), 1173 (8), 1186 (6), 1203 (1), 1228 (6), 1259 (4), 1324 (8*b*), 1361 (6), 1396 (3), 1415 (3), 1451 (7), 1483 (7), 1562 (10), 1595 (10), 1623 (9), 1709 (8), 1729 (6), 1982 (1), 2013 (0), 2234 (0), 2280 (1), 2343 (1*b*), 2470 (0), 2557 (0*b*), 2648 (2*b*), 2703 (0), 2721 (1), 2730 (0), 2826 (0), 2879 (1*b*), 2932 (0), 2987 (2), 3045 (8), 3063 (3), 3125 (3), 3149 (0), and 3197 (1) cm.$^{-1}$ The numbers within the brackets indicate visual estimates of the intensities of the lines. The exciting lines are 4046 and 4077 Å.U., and the 4358 radiations of the mercury arc were almost completely cut off by means of a filter of iodine in carbon tetrachloride.

The following characteristic features of the spectrum may be mentioned :—

1. Though organic compounds give in general only poor spectra in the crystalline state, coumarin has yielded a remarkably intense spectrum with a host of lines even in regions where they are difficult to observe even in liquid state.

2. The five low frequency lines at 34, 50, 65, 83 and 101 cm.$^{-1}$ which appear as a wing in the molten liquid, are intense, fairly sharp and well separated.

3. The C=O and C=C frequencies are split up into doublets, *viz.*, 1595 and 1623, and 1709 and 1729 cm.$^{-1}$ respectively, having nearly the same intensity.

4. There is a large number of intense lines in the region 1000 to 1500 cm.$^{-1}$ which are probably due to the rings in the molecule.

5. The characteristic frequencies of benzene and naphthalene molecules appear

more or less in the same position in coumarin.

A detailed discussion of the results in relation to the molecular structure of coumarin and to the pyrone ring will be shortly published elsewhere.

C. S. VENKATESWARAN.

Physics Department,
Indian Institute of Science,
Bangalore,
January 10, 1938.

The Spectra of Iodine V and I. VI.

THE spectrum of a highly condensed discharge through the vapour of iodine contained in very narrow capillary tubes has been photographed on Ilford special rapid plates by using a Quartz Littrow Spectrograph. A half-kilowatt transformer yielding about 30,000 volts in the secondary, was made use of and an auxiliary spark gap of length about a centimetre and a condensing capacity of 0·07 microfarads helped to increase the excitation.

The spectrum thus obtained contained many lines, which could be very easily suppressed by including a small series inductance in the exciting circuit, and could thus be assigned to the higher spark spectra of iodine. An examination of the data thus obtained revealed a prominent pair apparently due to I V in the region λ 3200–λ 2400. Use is also made of the list of Iodine lines recently published by Bloch and others.[1] Several lines, which included the characteristic regularities expected of the spectrum of I V could be selected and a term scheme developed, corresponding to that of Te IV[2] elucidated by Rao. The intervals $5p^2\ {}^2D_{1\frac{1}{2}}-{}^2D_{2\frac{1}{2}}$ and $5p^2\ {}^2P_{\frac{1}{2}}-{}^2P_{1\frac{1}{2}}$ were found to be 3073^{-1} cm. and 3328^{-1} cm. respectively. Many of the expected terms due to 5p, 6p; $5p^2$, 5d and 6s configurations were identified. The largest term $5p\ {}^2P_{\frac{1}{2}}$ yielded an ionisation potential of 31·6 volts for I V.

An investigation of the regularities to be expected in the lines of I VI was also undertaken in order to enable a useful classification of the lines due to Prof. Bloch referred to above. The very important intervals $5p\ {}^3P_0-{}^3P_1$ and $5p\ {}^3P_1-{}^3P_2$ are 3595 and 10430 wavenumbers respectively. As many as thirteen terms due to I VI could be identified. Further investigation of the spectrum of iodine is in progress and the results will be communicated shortly.

S. G. KRISHNAMURTY.
R. SANJIVARAO.

Andhra University,
Waltair,
December 20, 1937.

[1] *Jour. de Phy. et Radium*, 1937, **8**, No. 9.
[2] *Proc. Roy. Soc.*, 1931, A, **133**, 220.

The Third Spark Spectrum of Krypton Kr. IV.

HIGHLY condensed discharges through Krypton gas at various pressures were photographed by using a large Quartz Littrow Spectrograph. Adopting the usual methods of varying the intensities of excitation, such as the variation of the capacity, inductance and length of the auxiliary series spark gap, the lines due to Kr IV were easily identified.

Following the analysis of Se II,[1] and Br III,[2] carried out in these laboratories the fundamental multiplets, $5s\ {}^4P-5p\ {}^4D$, and $5s\ {}^4P-5p\ {}^4P$ in Kr IV were located. These led to the evaluation of the 5s, 5p and a number of the md terms. The difference $5p\ {}^4P_{1\frac{1}{2}}-{}^4P_{2\frac{1}{2}}$ is 348·1 cm.$^{-1}$. A few of the important lines are,

$5s\ {}^4P_{2\frac{1}{2}}-5p\ {}^4D_{3\frac{1}{2}}$	38310 cm.$^{-1}$	
${}^4P_{1\frac{1}{2}}-\ {}^4D_{2\frac{1}{2}}$	38225	,,
${}^4P_{\frac{1}{2}}-\ {}^4D_{1\frac{1}{2}}$	38146	,,

Full details of the analysis will be published shortly.

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S. G. KRISHNAMURTY.

Andhra University,
Waltair,
India,
December 22, 1937.

[1] *Proc. Roy. Soc.*, 1935, A, **149**, 56.
[2] *Ibid.*, 1937, A, **161**, 38.

Critical Temperatures of Liquids.

USING the surface tension measurements of Ramsay and Shields (1893), it has been shown that the calculated critical temperatures of liquids agree fairly with those observed.[1] Combining van der Waals' relation (1894) for the variation of surface tension with temperature and Macleod's equation (1923), and neglecting the vapour density in comparison with the density of the liquid, it follows that $\rho_\theta = \rho_0 \left(1 - \frac{\theta}{\theta_c}\right)^{3/10}$, where ρ_θ is the density of the liquid at an absolute

temperature θ, and θ_c the crit cal temperature.[2] This equation leads to the simple result,

$$\theta_c = \theta + \frac{3}{10a_\theta},$$

where a_θ is the coefficient of expansion of the liquid at θ. If Sugden's parachor equation (1923) is combined with Eötvös rule (1886), the above relation could again be deduced. If a_0 be the coefficient of expansion of a liquid at 0°C., its critical temperature on the Centigrade scale would be given by $\frac{3}{10a_0}$ — a relation dimensionally correct. The values of the critical temperatures thus calculated for a few liquids are compared with the values experimentally obtained in the following table:

Liquid	$\theta_c = 3/10a_0$ °C.	θ_c exptl. °C.
Acetone ..	226.6	235
Amyl Alcohol ..	337.0	307
Methyl Alcohol ..	252.8	240
Bromine ..	289.1	302
Carbon di-sulphide ..	263.1	273
Chloroform ..	271.1	263
Ether ..	198.3	194
Mercury ..	1648	>1550

It is far easier to estimate the critical temperature of a liquid from its coefficient of cubical expansion than from the variation of surface tension with temperature; it is needless to point out that the former could be more readily determined than the latter.

L. SIBAIYA.

Department of Physics,
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December 23, 1937.

[1] J. Newton Friend, *A Text-Book of Physical Chemistry*, 1932, 1, 264.
[2] *Ibid.*, p. 161.

The Natural Activators of Papain.

CONSIDERABLE interest has centred round the quest for the natural activator of papain and other plant proteases. The identification of the 'zookinase' of liver cathepsin,[1] and the 'phytokinase' of yeast protease[2] with glutathione has rendered probable the assumption that glutathione is the natural activator of papain and other plant catheptic enzymes. Grassman[3] investigated the nature of the activator of papain and came to the conclusion that the activator which gave a strong nitro-prusside test was not glutathione, but a peptide containing cysteine and glutamic acid. The occurrence of glutathione in the milky juice of *Calotropis gigantea* which contains an active proteoclastase[4] has been recorded.

Work on the natural activators of plant proteases is being carried out in this laboratory for some months past. This has led us to the conclusion that the latex of *Carica papaya* contains glutathione which serves as a natural activator of papain. This does not, however, preclude the possibility of other activators being present, such as the peptide isolated by Grassman. The glutathione which we have estimated by applying Woodward's procedure[5] constitutes only a fraction of the total SH-compounds present. Table I gives the concentration of glutathione in 3 samples of the latex. The concentration of total SH-compounds (calculated as glutathione) determined by the iodometric method after correcting for the ascorbic acid that is present, is also given in the table.

TABLE I.

No.	Glutathione mgm. in 100 gm. of latex	Total SH-compounds calculated as glutathione mgm. in 100 gm. of latex
1	120	2460
2	70	1470
3	110	1560

Attempts have been made to isolate glutathione by employing Pirie's method.[6] The characteristic silky white crystals of the cuprous compound of glutathione were isolated from acid solutions, but owing to the limited quantity of latex at our disposal, we have not been able to obtain glutathione in the crystalline form so far, but have only been able to carry out a few identification tests with the product obtained by the decomposition of the cuprous compound. Cysteine, in the free condition, is not present in the latex.

It would thus appear that there are at least two types of SH-compounds present in the latex: (1) glutathione, and (2) the "papainbegleitstoff X" of Grassman. SH-proteins also appear to be present and from the work of Purr[7] it appears probable that such proteins may also serve to activate papain.

It is of interest to record here, that the press-juice of pine apple—*Bromelia sativa* and of cucumber—*Cucumis sativus*, also contain glutathione. Quantitative results relating to these studies will be published elsewhere. It may thus be stated that glutathione is a natural activator of plant cathepsins.

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B. N. SASTRI.

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Indian Institute of Science,
Bangalore,
December 30, 1937.

1 Waldschmidt-Leitz and Purr, *Z. physiol. Chem.*, 1931, **198**, 260.
2 Grassman, Schœnbeck and Eibler, *ibid.*, 1931, **194**, 124.
3 Grassman, *Biochem. Z.*, 1935, **279**, 135.
4 Basu and Nath, *J. Ind. Chem. Soc.*, 1936, **13**, 34.
5 Woodward, *J. Biol. Chem.*, 1935, **109**, 1.
6 Pirie, *Biochem. J.*, 1930, **24**, 51.
7 Purr, *ibid.*, 1935, **29**, 13.

Note added when the above was in the press :—

Our attention was drawn to a note in *Nature* (1937, 140, 1015) received here on 1-1-1938 by Frankel and Maimin, concerning the natural activation of papain, wherein they state that it is "probable that the natural activator is glutathione. A decisive proof on this question must await complete chemical analysis." Our work besides giving a quantitative measure of the glutathione content of the latex of *Carica papaya*, has also shown, that the same tripeptide is present in the press-juice of several plant materials which are reputed sources of plant cathepsins.

Application of the Photoelectric Colorimeter for the Study of the Kinetics of Some Dehydrogenase Reactions.

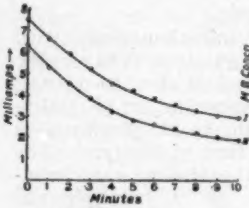
FOR the study of the dehydrogenase systems with methylene blue as hydrogen acceptor, the Thunberg technique involving the measurement of the time for complete decolorisation of the dye, is widely employed. In view of the fact that the disappearance of the colour is very gradual towards the completion of the reaction, the accuracy of the method is limited; further it does not permit of an accurate estimation of the concentration of methylene blue at any intermediate stage of the reaction. These limitations can be overcome by the employment of an objective photometer. Thus Pister[1] in his study of the dehydrogenase of *Azotobactor peroxidants* employed the Pulfrich Photometer using specially made tubes for measuring the changes in the concentration of the methylene blue.

The present communication deals with the results obtained in an attempt to employ the photo-electric method for measuring the variation in the concentration of methylene blue. The arrangement employed is essentially similar to that of Evelyn.[2] The source of light is an ordinary car head-light lamp mounted on a hemispherical reflector and fed by a 12-volt storage battery with a resistance in series. An ordinary Thunberg-Keilin tube containing the reaction mixture, placed in a holder with rectangular windows, serves as the cell. The transmitted light falls on a photronic cell (Weston type, No. 594) which is connected in series with a Weston D.C. milliammeter reading to 0·01 milliamperes.

A reference curve is first prepared using known amounts of methylene blue and a definite quantity of the enzyme preparation, suitably diluted. For studying the reaction the Thunberg tube with substrate (in the stopper), methylene blue and enzyme is first allowed to attain the temperature of the thermostat (37°·0 C.); the contents are then mixed, transferred to the holder after wiping the tube with a clean cloth and the intensity of the light passing through, measured. The measurement takes only a few seconds. The tube is immediately transferred back to the thermostat and after a noted time interval again taken out for measuring the intensity of transmitted light. In this way the course of the decolourisation of the methylene blue can be easily followed. From time to time the constancy of the intensity of the source of light is tested by intercepting the light beam with a cell containing pure distilled water.

The advantage of the method lies in its enabling an accurate estimation of the concentration of methylene blue at any stage, thus permitting the kinetics of the action to be followed. Experiments have been carried out with succinic dehydogenase (prepared from the ox heart[3]) and the decolorisation of methylene blue followed (1) at different temperatures, (2) with various concentrations of enzyme and substrate, and (3) in the presence of inhibitors like HCN, Pyrophosphate and heavy metals.

The results of a typical experiment are indicated in the accompanying graph.



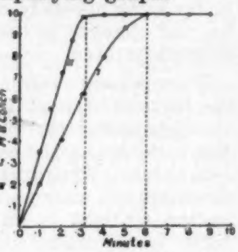


Fig. 1. **Fig. 2.**

Fig. 1. Calibration curves. (i) 0·5 c.c. and (ii) 1·0 c.c. enzyme, 5 c.c. phosphate buffer, pH 7·6, 1 c.c. 0·02 per cent. methylene blue and water to make up 10 c.c.

Fig. 2. Dehydrogenating action of succinic dehydrogenase. (i) 0·5 c.c. and (ii) 1·0 c.c. enzyme, 5 c.c. of phosphate buffer, pH 7·6, 1 c.c. M/10 sodium succinate, 1 c.c. 0·02 per cent. methylene blue, and water to make up 10 c.c.

The method will be found applicable to the study of systems involving changes in intensity of colour and in turbidity.[4] By employing appropriate colour filters greater accuracy will be rendered possible.

C. V. Ganapathy.
B. N. Sastri.

Department of Biochemistry,
Indian Institute of Science,
Bangalore,
December 14, 1937.

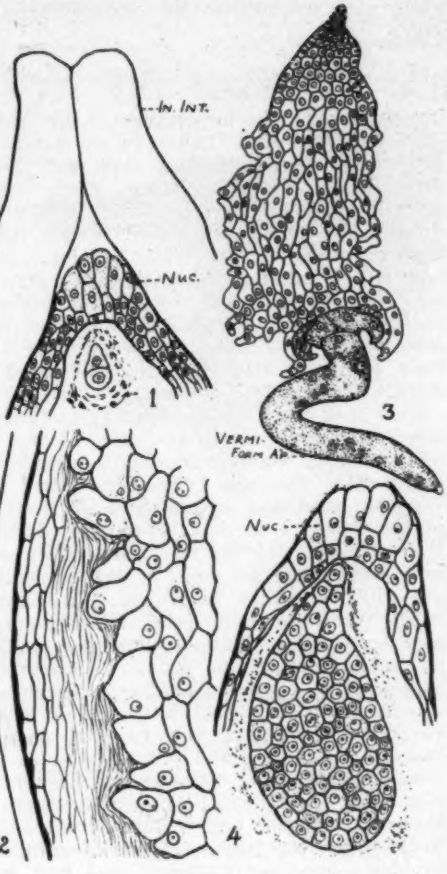
1 Pister, *Z. Physiol. Chem.*, 1937, **246**, 248.
2 Evelyn, *J. Biol. Chem.*, 1936, **115**, 63.
3 Malherbe, *Biochem. J.*, 1937, **31**, 300.
4 Sreenivasaya, Unpublished work. The method was employed for studying the kinetics of the peptic hydrolysis of isolated proteins ; and later, extended to the study of the peptic hydrolysis of casein in its natural and artificial environments.

The Endosperm in *Grevillea robusta* Cunn.

In the literature on the Proteaceæ, the papers by Ballantine (1909)[1], Messeri (1928)[2] and Brough (1933)[3] stand out conspicuously as important recent contributions. The most complete of these papers is by Brough who, in a study of *Grevillea robusta* Cunn. gives an exhaustive account of floral organogeny, pollination and seed morphology and discusses the systematic position of the family. He also describes significant phases in sporogenesis, development of the gametophytes, endosperm and embryo and states that the haploid number of chromosomes is ten.

The following account of the same species is intended to describe certain features in the life-history which are either not mentioned by Brough or appear to be at variance with his observations. The tip of the nucellus fits into the micropyle as a conical projection and is almost intact with its glandular cells (Fig. 1) till after the formation of the embryo. On the other hand, Brough's Figures 73 and 80, particularly the former, suggest that the tip of the nucellus has disorganised and consequently the endosperm is slightly projecting into the micropyle in Fig. 73. The endosperm does not enter the micropyle at the stage depicted in Brough's figure and even later when the nucellar tip is disorganised, the endosperm is also broken down by the embryo at the region of the micropyle. The cells of the nucellar tip have dense contents and no doubt serve to nourish the growing embryo for some time, after which they disorganise and the embryo therefore becomes lodged in the micropyle.

In the formation of the endosperm, while cell formation is complete only in the upper half of the embryo-sac, it proceeds more or less sluggishly in the lower region as stated by Brough. The present author has been able to discover that the lowermost region remains cœnocytic and grows as a large *vermiform appendage* of the endosperm, penetrating through the cells at the base of the nucellus and breaking them down, where a large mass of cytoplasm is therefore formed. In addition, the marginal cells at the base of the endosperm grow in the form of processes and attack the cells of the nucellus all along the sides of the embryo-sac (Fig. 2). A large cavity is thus later formed all round the embryo-sac by the disorganisation of the nucellus, which persists only as a very thin layer within the integument in the developing seed. The entire mass of endosperm, which in the early stages of embryo formation is hanging loose within this cavity, can therefore be easily picked up with the aid of a dissecting needle and mounted whole for examination. Such a preparation reveals remarkably clearly the complete mass of endosperm with its marginal cells in the form of processes (simulating the marginal cells of the foot of the sporophyte in *Anthoceros*) and the very curious coiled *vermiform appendage* (Fig. 3) which is described here for the first time. On the other hand, a



Figs. 1–4.

Figs. 1 & 2. × 200; Fig. 3. × 280; Fig. 4, very highly magnified from a whole mount.

mere examination of serial microtome sections does not give a complete picture of the peculiarly developed endosperm and its interesting features may therefore be overlooked.

In the many celled embryo, the proximal region appears to be more or less wedge-shaped and the cells are larger with less dense contents than those in the more distal region (Fig. 4). The change in the shape of the embryo, as described by Brough, is not attained. His statement of the absence of a suspensor is however fully borne out by the present investigation.

S. B. Kausik.

Department of Botany,
Central College,
Bangalore,
December 20, 1937.

[1] Ballantine, A. J., *Ann. Bot.*, 1909, **22**, 161–62.
[2] Messeri, A., *Nuovo Giorn. Bot. Ital.*, 1928, **34**, 1037–42.
[3] Brough, P., *Proc. Linn. Soc. New South Wales*, 1933, **58**, 33–73.

Rottlerin—Part III.

The difficulty of explaining the nitrogen trioxide addition product of methyl ether of rottlerin has been emphasised in Part II. It now appears that if the formula for rottlerin is taken to be $C_{31}H_{30}O_8$, then the methyl ether m.p. 144° described before, becomes a penta-methyl ether of the composition $C_{36}H_{40}O_8$ and the hydrogen peroxide oxidation product (m.p. 128°) becomes $C_{36}H_{40}O_9$. The analytical value for this oxide was found to be C, 70·06; H, 7·2, and (C, 69·87, H, 7·1 in duplicate) whilst $C_{36}H_{40}O_9$ requires C, 70·01 and H, 6·5; and $C_{36}H_{42}O_9$ requires C, 69·9; H, 6·8%. By the action of sodium nitrite either with acetic or butyric acid, the same product m.p. 207° (decomp.) is formed. Therefore, in the formation of this compound an acetic acid residue could not have been fixed by the molecule. If simple N_2O_3 be fixed by the molecule at one of the double bonds and the methyl ether be taken as $C_{36}H_{40}O_8$, then the additive product becomes $C_{36}H_{40}O_{11}N_2$ requiring C, 63·9, H, 5·92 and N, 4·14, whilst values found were C, 63·87; H, 5·9 and N, 4·2%. The dihydro derivative m.p. 162° requires 63·7; H, 6·2; N, 4·1 on the basis of formula $C_{36}H_{42}O_{11}N_2$ whilst the values found were C, 63·44; H, 6·23 and N, 4·0%. The *iso* and the dihydro *iso* bodies necessarily will also be accommodated by this formula.

The M.W. of tetrahydro rottlerin has been found to be 507 whilst $C_{31}H_{34}O_8$ requires 534. The methyl ether (m.p. 144°) has given M.W. in a recent determination as 572, whilst $C_{36}H_{40}O_8$ requires 600.

K. S. Narang.
J. N. Ray.
B. S. Roy.

The University, Lahore,
January 15, 1938.

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REVIEWS.

Our Natural Resources and their Conservation. By A. E. Perkins and J. R. Whitaker. (John Wiley & Sons., Inc. New York; Chapman & Hall, Ltd., London), 1936. Pp. 650. Price 25*s*.

We have read this book with great profit. The amount of information presented to its readers is almost encyclopædic in range, and every chapter bears the stamp of authority. The co-operative plan on which the book is based has secured for it the positive advantage of a general survey of the entire field, so essential in advancing and familiarising the educational section of the conservational programme. Twenty-two authors have contributed and the joint authorship has rendered the work far more authoritative than a single author could have made it. In a symposium of this magnitude, there is bound to be duplication of material, contradictory individual opinions and differences of view-point both as regards state policies and facts. Instead of being shortcomings, they have invested the book with excellent special features in respect of the conservational theory and practice. Co-operative authorship is becoming a leading feature of most modern books which attempt to deal with a wide field in which the view-points and contributions of the administrator, field worker, scientist and philosopher could be blended into a systematic and comprehensive treatise.

The book expounds the achievements of the American Government and the local bodies in conserving the natural resources of the United States and the early recognition of the fact that the wealth of the country is a national asset which ought to be protected and utilised for the benefit of the whole population has resulted in the formulation of several restrictive laws in whose administration several associations co-operate. It will be recalled that in 1908, President Theodore Roosevelt summoned a Conference at the White House at which, in a remarkable speech, he emphasised the great need and importance to the nation, of conserving the natural resources and of properly using the variety of gifts with which nature has endowed the American people. The delegates who attended the Conference were so impressed with the importance of the problems presented that they drew up a set of supporting resolutions and expressed their determination of appointing State conservation Commission in their respective states. The policy enunciated at this Conference, supported by public opinion, has been the foundation of a nation-wide organisation throughout the country for a close and scientific survey of all the national resources and of a judicious programme for their economic utilization for the people's welfare and prosperity.

This book has a special interest to Indian administrator, scientist and man of public affairs. This country presents a singularly unfortunate spectacle of vast resources on the one hand and starvation and poverty on the other. India has not recognised that the problems of conservation—wise and safe utilization—of her potential wealth are vital to every individual. We have hardly projects and programmes—except some spasmodic efforts—applicable to the particular resource or group of resources. The time is opportune. The autonomous provinces should establish commissions for the investigation of the national wealth and draw up plans and programmes for its development and utilisation. Conservation does not imply the care and preservation of the forests and woodlands only, but in the widest acceptance of the term embraces problems relating to recreational and historic sites, the maintenance of the fertility of soils, the prevention of soil erosions, the control of floods, the careful mining of metals and of fuels, the protection of wild life including the fish of the fresh waters and of the sea, the preservation of the primitive beauty of the landscapes, the conservation of human life and culture of the nation. The spirit of conservation is not part of the composition of the public opinion in India and unless it forms an integral part of the national administrative policy, India must have undeveloped wealth and widespread poverty as inseparable twins of her national life. The first step towards developing and expanding our resources, is an intelligent and critical appreciation of

(*Continued on page 342.*)

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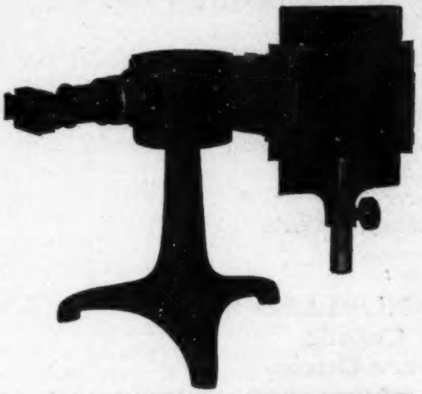

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